

CLAIMS

1. An apparatus for sensing shear, the apparatus comprising
a first piece,
5 a second piece movable relative to the first piece along a shear plane,
and
a sensor interposed between the first piece and the second piece, a first
portion of the sensor being stationary relative to the first piece, a second portion of the
sensor being stationary relative to the second piece, and a third portion of the sensor
10 being deformed as the second piece moves relative to the first piece along the shear
plane, the sensor having an output signal indicative of the amount of deformation of
the third portion.
2. The apparatus of claim 1, wherein the first portion of the sensor
is in contact with the first piece and the second portion of the sensor is in contact with
15 the second piece.
3. The apparatus of claim 1, wherein the sensor comprises a strain
gauge coupled to the third portion.
4. The apparatus of claim 1, wherein the first piece includes a
stop, the first portion comprises a first surface that engages the stop, and the second
20 portion comprises a second surface that is coupled to the second body.
5. The apparatus of claim 4, wherein the second surface is
perpendicular to the first surface.
6. The apparatus of claim 4, wherein the third portion of the
sensor has a third surface and the sensor comprises a strain gauge that is coupled to the
25 third surface.
7. The apparatus of claim 1, wherein the first, second, and third
portions of the sensor are formed integrally from a mass of resilient material.
8. The apparatus of claim 7, wherein the resilient material
comprises an elastomeric material.
- 30 9. The apparatus of claim 7, wherein the resilient material
comprises a metal material.

10. The apparatus of claim 1, wherein the sensor comprises a load beam, the first portion comprises a first end region of the load beam, the second portion comprises a second end region of the load beam, and the third portion comprises an intermediate region of the load beam that interconnects the first and second end regions.

11. The apparatus of claim 10, wherein the load beam has a first slot between the first end region and the intermediate region and the load beam has a second slot between the second end region and the intermediate region.

12. The apparatus of claim 1, wherein the first piece comprises a first plate, the second piece comprises a second plate, and the sensor comprises a flat element that is situated between the first and second plates.

13. An apparatus for sensing shear, the apparatus comprising a first piece comprising a first plate and a first stop coupled to the first plate,
a second piece comprising a second plate and a second stop coupled to the second plate, the second plate being arranged in parallel relation with the first plate, the second piece being movable relative to the first piece along a shear plane that is parallel with the first and second plates, and

a sensor comprising a body and a strain gage coupled to the body, a portion of the body being situated between the first and second stops, the portion of the body being deformable as a result of the second piece moving relative to the first piece along the shear plane, a resistance of the strain gage changing as a result of the portion of the body being deformed.

14. The apparatus of claim 13, wherein the body has a first hole and the first stop includes a first post that is received in the first hole.

15. The apparatus of claim 14, wherein the body has a second hole and the second stop includes a second post that is received in the second hole.

16. The apparatus of claim 14, wherein the first post is received in the first hole with a press fit.

17. The apparatus of claim 16, further comprising a spacer coupled to the first post, the spacer being situated between the body and the first plate, and the body being held out of contact with the first plate by the spacer.

18. The apparatus of claim 14, wherein the second piece comprises a rim extending from the second plate, the rim has a surface that engages the first plate, and a portion of the rim provides the second stop.

19. The apparatus of claim 18, wherein the rim surrounds the body.

5 20. The apparatus of claim 13, wherein the body has a first slot on one side and a second slot on an opposite side, the slots defining a load-sensing intermediate region therebetween.

21. The apparatus of claim 13, wherein the body comprises a third plate that is substantially parallel with the first and second plates.

10 22. The apparatus of claim 21, wherein the third plate has a first end region that engages the first stop, the third plate has a second end region that engages the second stop, and the third plate has an intermediate region that interconnects the first and second end regions.

15 23. The apparatus of claim 22, wherein the third plate has a first slot between the first end region and the intermediate region and the load beam has a second slot between the second end region and the intermediate region.

24. An apparatus for sensing shear, the apparatus comprising
a first plate,
a second plate,
20 a middle plate sandwiched between the first and second plates, the middle plate being deformable, and
a strain gage coupled to the middle plate.

25. The apparatus of claim 24, further comprising a first stop configured to mount the first plate to the middle plate.

25 26. The apparatus of claim 25, further comprising a second stop configured to mount the second plate to the middle plate.